Testimony of
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INTERNATIONAL POLAR YEAR

Before the
House Committee on Science

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Thank you, Mr. Chairman, for the opportunity to testify before the Committee concerning the upcoming International Polar Year (IPY) and on how NSF and our sister agencies are addressing this important opportunity. Our job is to enable U.S. scientists and educators to realize these opportunities, opportunities that members of today's distinguished panel will be speaking to in more detail.

We intend for the International Polar Year period--which has been declared by the International Council of Science (ICSU) and the U.S. National Academies (NAS) to be from March 2007 through March 2009--to explore new frontiers in polar sciences; improve our understanding of the critical role of the earth's polar regions in global processes; create a legacy of infrastructure and data for future generations of scientists; expand international cooperation; engage the public in polar discovery; and help attract and educate the next generation of scientists and engineers.

Fifty years ago, the Third International Polar Year and International Geophysical Year entranced America's youth and galvanized America's innovative powers in ways that created a legacy that lives on today. That legacy ranges from scientific earth satellites to the development of a generation of world-class scientists and engineers who drove our knowledge-based economy forward for the next half-century.

Advances in instrumentation and technology, the realization that polar regions are critical in the changing global climate system, and linkages among international research organizations offer opportunities for breakthrough developments both in fundamental disciplinary science and in science for policy during IPY. In addition, the impacts of climate change on northern communities, and more generally, on ecosystems in polar environments strongly motivate a broader focus than the last IPY had. The NSF tradition of linking research and education offers the further opportunity to engage America's

youth in this period of discovery and awaken them to the excitement of a career in science and engineering.

In his introduction to the "American Competitiveness Initiative, Leading the World in Innovation", President George Bush stated that a “well-educated and skilled workforce is the bedrock of America's competitiveness.” U.S. institutions of higher learning remain the envy of the world, but the global economy has greatly increased the competition for the best and brightest students. America must ensure that its best and brightest young people give appropriate consideration to careers in science and engineering and that they take advantage of the fact that ours is the most open educational system in the world. NSF, its sister agencies and IPY have a key role to play in achieving this goal.

NSF has been tasked by the White House Office of Science and Technology Policy to provide leadership for the U.S. in IPY. And, the agency is poised to do exactly that, both domestically and on the broad international stage. We have worked closely with our colleagues in other federal agencies and with the NAS to that end over the last two and a half years. Back in July 2004, I was pleased to be invited to deliver the keynote address at a meeting organized by the three Presidents of the NAS that was devoted to IPY planning. With your permission, I would like to enter my remarks for the record. As I said then, and I quote:

> Both the National Academy of Sciences and the International Council of Science have made a compelling case for why we should launch an international polar year in 2007. NSF is in full agreement. In the polar regions, we are discerning the outlines of environmental change, from sea ice extent, retreating glaciers, shifting patterns in flora and fauna, to environmental observations by Arctic natives.
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> What is more, such change—whether environmental, biological or social—has implications for the rest of the globe. Polar change ripples across the planet on a spectrum of time scales, through the atmosphere, oceans, and living systems.
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> We do not yet fully understand the causes of what we are observing. Now is the time to change this, for new tools make possible the needed observations and synthesis. They range from satellites to ships to sensors, and from genomics to nanotechnology, information technology, and advances in remote and robotic technologies.

The NAS subsequently conducted a year-long study to develop a Vision for the International Polar Year, one that would take advantage of the broad expertise of the U.S. scientific community; position the U.S. for world leadership in IPY; and most importantly, create a long-term legacy that would not otherwise exist. This Vision is providing a framework for IPY planning among the federal agencies. It was developed under the leadership of Dr. Mary Albert of the U.S. Army Cold Regions Research and Engineering Laboratory in Hanover, New Hampshire, and I believe my colleague on the panel, Dr. Robin Bell, will outline its recommendations in more detail. Robin chairs the

NAS/National Research Council (NRC) Polar Research Board that oversaw the work of Mary's committee. They both have earned our continuing gratitude and congratulations.

In exercising NSF's leadership role, I also convened several meetings of the policy-level officials to discuss IPY planning. These activities resulted in a report we provided to the Congress last year and a number of agencies have taken the opportunity to update their sections of the report for this hearing. With your permission, Mr. Chairman, I would like to submit a copy for the record and mention a few highlights.

NASA is holding discussions with space agencies around the world to organize a coordinated program to map the polar regions using today's sophisticated satellites. NSF and NASA are working together to coordinate space- and ground-based observations in order to provide future generations of scientists and others with a comprehensive body of benchmarked data. These data will greatly increase our ability to discern change on a regional basis--a basis that relates directly to the different environments in which people work and live.

The Department of Commerce's National Oceanic and Atmospheric Administration (NOAA) and NSF are developing atmospheric, land and ocean-based environmental monitoring capabilities that will be key components of the planned circum-Arctic Observing Network (AON), which will significantly enhance our observing capability in the Arctic region beyond that currently available. Data from this AON will enable the U.S. multi-agency program SEARCH--the Study of Environmental Arctic Change--developed under the Interagency Arctic Research Policy Committee to get a handle on Arctic environmental change.

Here, too, the NAS have helped significantly with an NSF-funded study of how best to implement AON. A circum-Arctic system requires active contributions from countries around the Arctic rim. We have already developed strong links for coordination with the $30-million European program called DAMOCLES; have initiated discussions with our Canadian colleagues; and have joined with Norway, Sweden and Germany and Russia in establishing an office in St. Petersburg to assist with linking Russian activities to AON. NOAA has led an effort to build U.S.-Russian Federation collaboration in ocean and polar region studies, as highlighted by the Russian American Long Term Census of the Arctic RUSALCA program. This will be a key U.S.- Russian component of the IPY. NOAA in collaboration with NSF, also leads the U.S. participation in the IPY International Arctic System for Observing the Atmosphere

Additional IPY efforts by NOAA, NASA and other sister agencies are described in the attached document entitled, "The International Polar Years 2007-2009."

NSF's Office of Polar Programs (OPP) and the Directorate for Education and Human Resources (EHR) combined to jumpstart IPY preparations by committing $12 million from their FY06 appropriations to a special IPY proposal solicitation. The solicitation drew a very strong response from U.S. scholars; taken together the proposals requested over $150 million in the four focus areas (three science areas and education).

We chose to focus on areas that for one reason or another needed extra lead time for preparation and that would represent a good start toward realizing the NAS/NRC Vision. The NSF merit review of the education proposals was completed just a few days ago, and the results exemplify the creativity and the enthusiasm of our educators and scientists. I expect to be able to announce the results from the three research areas by the end of October. Meanwhile, the program officers overseeing the merit review process tell me the quality of the proposals is outstanding.

Building on this excellent FY06 start, NSF Program Officers from the agency's disciplinary directorates are working with OPP to formulate how best to respond to IPY opportunities in FY07 and FY08. On the basis of their work, the Administration requested $62 million in FY07. And, I'm very happy that both Houses of Congress have signaled their agreement with our IPY agenda.

The strong partnership created with EHR in developing the FY06 solicitation is the very first legacy of IPY; it will ensure an effective outreach and education effort throughout the upcoming two years and well into the future. A strong partnership with the NSF's Office of International Science and Engineering (OISE) is enabling rapid development of new international links as well as a strengthening of existing ones. IPY planning by the Biological and Social, Behavioral, and Economic Sciences Directorates and studies by the NAS/NRC have identified an exciting group of leading-edge research subjects in biology and the social sciences, ones that with strong IPY support and focus could create 21st century legacies. The Geosciences Directorate and OPP have a long history of joint cooperation for proposals, and IPY provides a strong basis for developing new partnerships in key focus areas such as climate studies. The Mathematical and Physical Sciences Directorate and OPP have an outstanding partnership in astrophysics at the South Pole, another excellent IPY building block. Thus, there is great potential for creating legacies through research achievements, a new generation of American scientists and engineers, and new networks of international collaborations.

The aforementioned solicitation identified three science themes and a strong education focus as key investment areas for special emphasis during FY06. These themes will be developed further during FY07 and FY08. A cross-directorate working group is evaluating the extent to which the original focus areas will have been addressed by the FY06 solicitation and how they can be broadened to address more of the Vision developed by the NAS. NSF and the Office of Management and Budget will soon discuss how to address these focus areas in the FY08 budget request to Congress.

The first of these research themes addresses climate change in the Arctic by contributing to building the Circum-Arctic Observing Network (AON) that I mentioned earlier. This program was organized under the direction of the U.S. Interagency Arctic Research Policy Committee chaired by the NSF Director and involves partnership with NOAA, NASA, DOI, DOE, NIH, DOD, USDA and the Smithsonian Institution.

During the past few decades, the Arctic has experienced significant environmental changes that could have broad-reaching consequences for human and animal populations in the form of impacts on local ecosystems, as well as on global climate. The AON will provide a network of observations that will facilitate our understanding of the profound change that is occurring in the Arctic. To achieve this goal, Cyberinfrastructure (CI) will need to be developed to provide interoperability between the various elements of the observing network, seamless broadband communications capabilities at the poles, data storage and archive capabilities, and timely access to data. This initiative will not only support the Foundation's broader CI interests, it also supports the broader administration goal of developing a Global Earth Observing System (GEOS). Any CI communications technology that is developed to support the AON could potentially be used to enhance communications capabilities at the South Pole.

A second broad theme addresses research on what we're calling Life in the Cold and Dark. Relatively recent developments in instrumentation and technology offer the opportunity to study the mechanisms by which organisms adapt to the climate extremes they face in polar environments, how they have evolved at the genomic level and how gene expression depends on the physical environment. A recent NAS report, "Frontiers in Polar Biology in the Genomics Era," outlines the opportunities and challenges, and describes the ecological relevance and research benefits of these tools of modern biology. The Life in the Cold and Dark theme also encompasses research on the interactions between living and physical systems at all levels and brings together researchers trained in the Biological and Social Sciences.

The last International Polar Year in 1957-58 focused almost entirely on physical science but IPY 2007-2009 will be different. Many northern languages are now spoken by only small numbers of elderly people and NSF will partner with the National Endowments for the Humanities in the U.S. and with Canada and other countries in sponsoring work to document those endangered languages in Alaska and throughout the Arctic.

NSF-supported research also will address issues associated with environmental change that are of critical importance to people living in the North. These studies, sponsored jointly by NSF and NIH, will seek to determine not only what causes change and predicting it more accurately, but also how change allows infectious diseases to move into new areas where vulnerability is high because the people and wildlife will not have developed resistance to the novel pathogens that will be moving into these regions.

The third broad theme addresses changes in the earth's great ice sheets, changes that could have profound impacts on global conditions including global sea level. Recent data indicate that the Greenland ice sheet is thinning at the edges but thickening at the center. Some ice streams draining the West Antarctic Ice Sheet have slowed while at least one other is accelerating. Relatively small changes in the mass balance of these ice sheets can raise global sea level significantly while complete loss of the West Antarctic Ice Sheet would raise global sea level by over five meters. Furthermore, a combination of ground-based, airborne, and satellite observations shows that surface melt water can penetrate the ice sheet at thicknesses of a kilometer and accelerate flow beyond previously suspected

rates. Research supported by NSF, NASA and other agencies under this theme will combine with work supported by many other countries to develop a much more complete understanding of the behavior of these ice sheets and how changes in this behavior might evolve. The theme will also address further studies of ice sheet changes that occurred over geological time and the causes and effects of those changes.

The overall scientific impact of IPY will only become apparent through synthesis activity that brings together results from disparate research groups addressing different aspects of these broad themes. NSF recognizes the critical importance of funding workshops and related activities to that end, and will do so well beyond the end of the two-year IPY period.

The education focus has the potential to create a legacy for the decades, one that will benefit the nation as well as the science and engineering community more specifically. By linking the public's fascination with things polar to outreach that conveys the excitement of research and discovery, we hope to attract a new generation of Americans into S&E careers while contributing to a more informed public.

With the jumpstart provided by the EHR/OPP FY06 solicitation NSF will enter the IPY period well-placed to make major impacts during the ensuing two-year period. A multi-year outreach and education strategy will have substantially greater impact than one limited to a single year, while the international collaborations that can greatly enhance the reach and impact of NSF-supported research will also hinge on continued support.

While our outreach and education strategy will be focused on U.S. students, parents and families, we recognize that IPY also brings the opportunity to demonstrate to them how research and understanding can result when people from many nations work together on problems of global interest. The many international scientist-to-scientist collaborations now developing will help us carry that story to our public and to others around the world.

Indeed, part of the IPY impact will be the enduring partnerships established among scientists in the over 30 countries that have signaled their intention to provide funding for IPY activity. Countries around the world have seized on the 50 year anniversary of IPY-3/IGY to create a new legacy of scientific understanding and a new generation of scientists and engineers. We understand that Canada has committed $150 million over six years to its IPY effort, Korea - $150 million, Japan - $460 million for a new icebreaker, China - $60 million for infrastructure and research. Among the EU commitments one exceeds $30 million for a project closely linked to the U.S. IPY centerpiece addressing climate change in the Arctic.

The 1957-1958 International Polar Year culminated in an international meeting in Washington called by the State Department to frame what became the Antarctic Treaty. As President Reagan noted in 1970, "…the Antarctic is the only continent where science serves as the principal expression of national policy and interest." The State Department plans to host the annual meeting of the Antarctic Treaty Consultative Parties in 2009, which will spotlight the historic diplomatic achievement by the Treaty Parties 50 years

ago. We expect this new IPY to create a further legacy of international partnerships in the interest of advancing scientific research and understanding.

The U.S. research community is poised to provide worldwide leadership throughout IPY, and NSF is committed to enabling that to the best of our ability.